MANITOBA FORESTRY

Manitoba
Natural Resources

THE FORESTRY BRANCH

EIGHTH ANNUAL REPORT

1990-1991

MANITOBA NATURAL RESOURCES

Includes 10% post-consumer waste and is recyclable where local facilities exist.

92-03988/

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FORESTRY BRANCH MISSION AND ROLES

The mission of Manitoba Natural Resources, Forestry Branch is to ensure sustainable development of provincial forestry resources for present and future generations of Manitobans.

The Branch supports and promotes forest harvesting and manufacturing through long-range planning and forest-management efforts to optimise the use of forest resources, sustain and enhance the existing industry, and to assist in the establishment of new industries.

The Branch administers *the Forest Act* and *the Dutch Elm Disease Act*; develops, implements and evaluates commercial harvesting plans for manitoba's forests; administers timber-cutting licensing and measurements; plans and co-ordinates reforestation and forest stand tending; maintains a forest inventory; and develops and implements forest protection programs, including the control of dutch elm disease.

Specific objectives of the Forestry Branch include:

1. To ensure that the Crown owned forest land base is managed to provide an adequate resource base for existing and future harvest operations and an adequate forest cover for conservation of land resources.

2. To manage the elm population in urban centres in the Province to lessen the impact of Dutch Elm Disease.

3. To prevent widespread tree mortality and timber losses by providing a level of forest protection commensurate with the values at risk.

4. To manage and allocate forest resources in a manner which attempts to optimize the long-term social and economic benefits to Manitobans.

5. Ensures that all forest harvesting operations are performed in a manner which minimizes losses and environmental damage.

6. To allow other resource use opportunities within designated forestry lands where the opportunities complement and do not conflict with existing or future forest harvesting operations.

7. To ensure that forest resources are managed and utilized on a sustained yield basis.

8. To ensure that silvicultural and regeneration measures are developed and implemented in order to maintain or improve the standing supply of timber.

9. To ensure that the Crown obtains a fair return for the use of its forestry resource.

The Forestry Branch's Forest Management, Silviculture, Forest Protection, and Forest Operations Sections are charged with meeting these objectives through their activities.

INTRODUCTION

The close of the fiscal year marked another milestone in co-operative forestry programming between Manitoba Natural Resources, Forestry Branch and Forestry Canada with the signing of a new five year Partnership Agreement in Forestry. Negotiations during the last quarter of the year moved into high gear and a cost-shared agreement between Canada and Manitoba was signed on March 25th, 1991. The $30 million agreement is cost-shared on a 50/50 basis for the five year period beginning April 1st, 1990. This agreement (which runs until March 31st, 1995) builds on the achievements of the earlier 1984-1989 forest renewal agreement. It reflects the new realities in contributing to the economic strength and diversity of the forest sector, within the context of a sustainable development strategy.

The agreement comprises three programs: reforestation and wood supply enhancement; applied research, marketing and technology transfer; and public information, education and agreement support. These programs are managed by an Agreement Management Committee and are implemented by Forestry Canada and Manitoba Natural Resources, Forestry Branch. A more detailed breakdown of the programs, sub-programs, projects, and funding allocation is provided in the publication *Canada-Manitoba Partnership Agreement in Forestry* available from the Manitoba Forestry Branch or the Forestry Canada office, Winnipeg.

Organizational structure of the Manitoba Forestry Branch remained essentially the same during the fiscal year. Some minor changes to staffing occurred in all four sections of the branch resulting from shifts in programming or shifts in responsibilities to various staff.

Several forest policy initiatives that were begun during the previous fiscal year were concluded satisfactorily during 1990. The first of these saw the conclusion and assent given to Bill 9, an amendment to The Forest Act, which allowed for the assessment of a Forest Renewal Charge payable by all persons harvesting provincial Crown timber. It is expected that a regulation identifying the fee structure will be brought forward to the Lieutenant-Governor-in-Council early in the new fiscal year.

A second undertaking was concluded that pertained to implementing changes to the quota system for the operating period 1990 to 2000. The recommendations made by the consultants were assessed by the department and a number were incorporated. One of the most important was the recommendation to allow splitting of softwood or hardwood quotas into smaller portions of 1000 cubic metres, which can be more easily handled financially by persons wishing to enter into the forest industry via the quota system.

Another important change pertained to the utilization formula. Quota utilization will be considered to have occurred if 60% of the volume is used over a five year period. The previous standard was set at 80%. The new limit better reflects cyclic market trends for most forest products. A more complete listing of the changes to the quota system can be obtained from the Manitoba Forestry Branch, Timber Sales Office.

Considerable effort by branch representatives on the Sustainable Development Technical Advisory Committee on Forestry resulted in completion of the draft material for the publication entitled *What You Told Us - Forests*. This publication is the follow-up to the 14 workshops that were

held throughout the province and the mail-in portions of the *Sustainable Development Strategy for Forests - Workbook*. The publication will contain comments received at the workshops and the revised versions of policies that were initially presented in the strategy for forests workbook. It is expected that the publication will be finalized, printed and released during the next fiscal year.
The policies in the forest strategy will outline how forest management will occur in Manitoba. As a result, this will be a key document for developing the 20 Year Integrated Forest Management Plan required by the Canada-Manitoba Partnership Agreement in Forestry.

The close of the fiscal year, March 31st, 1991, ends a five year period for which a report on the status of forests will be prepared for the Legislature, a requirement under The Forest Act. This will be the second report to the Legislature of this type, the first covering the five year period ending March 31st, 1986. The second report to the Legislature is due December 31st, 1991.

During fiscal year, grant assistance was provided to the Manitoba Forestry Association (MFA) and the Forest Engineering Research Institute of Canada (FERIC). Both agencies provided support and technology transfer respecting the branch's programs, particularly in communication and education of school children and information about forest product manufacture by Manitoba's forest industry.

As a result of recommendations made at the 1990 Forestry Branch meeting, a number of strategies were developed to improve delivery of branch programs. Of particular note was increased focus on integrated forest management with other resource branches. This has been achieved by establishing an integrated resource management board of directors and regional integrated resource management teams. The integrated management initiative will be more fully developed during the next fiscal year.

Another important area which generated recommendations at the 1990 Branch meeting was education and communication. A number of activities associated with these will be developed through the assistance provided by the Canada-Manitoba Partnership Agreement in Forestry during the next four years.

FOREST MANAGEMENT

Introduction

The severe 1989 wildfire occurrences continued to have an impact on section activities throughout the year. By year end both the 1989-1990 and 1990-1991 fiscal years area and volume fire losses were completed.

Development of a private land forestry (Farm Woodlot) program continued with the woodlot interest survey results printed and distributed. Numerous woodlot investigations were conducted with on site "walkabout" visits with owners. Educational talks to interested groups were held at various locations in southern Manitoba. Two (2) projects looked at the use of Manitoba Maple for the production of Maple Syrup and the growing of mushrooms (Shiitake and Oyster) on farm woodlots.

Forest Survey maintenance activity was conducted in a portion of the Highrock forest section. Permanent sample plots designed to track forest growth changes over time continued to be established in representative forest stands across the province. Permanent plots in the Interlake forest section were remeasured to establish growth trends and to predict volume accumulations into the future.

No new forest inventory reports to provide new annual allowable cut (AAC) levels for the Province were completed. Delays in completing the 1989 fire losses resulted in the decision to postpone new calculations, for both the Nelson River and Highrock forest sections, to allow for updating of fire losses incurred. Development of computer programming to assist in the processing of area and volume information relative to the calculation of the annual allowable cut, based on sustained yield, will be completed next year.

The Forestry Geographic Information System (FORIST) operated throughout the year on a single shift basis and a second shift operated for three (3) months. Entry of forest cover data into computer storage was completed for portions of the Lake Winnipeg East, Interlake, Highrock and Nelson River forest sections of the province. Geographic information for the Forest Management Licence Agreement (FML) Number 2 was provided for Repap Manitoba, as a requirement for the Environmental Impact Assessment (EIA).

The Boreal Ecosystems - Atmosphere Study (BOREAS) research project, of the boreal forest of North America has selected a prime northern site at Nelson House, Manitoba and a southern site at Prince Albert National Park, Saskatchewan. The project, to start in 1993, will study the interactions between the boreal forest biome and the atmosphere in order to clarify their roles in global change. Forest Management Section and the Forestry Branch's Northern Region have been co-operating with the Boreas Committee, providing information on aerial photography and forest cover mapping.

Aerial Photography

Approximately 80% of the 12,600 km^2 targeted for aerial photography in Forest Management Unit 82 of the Nelson River Forest Section was completed on schedule (Table 1). Due to

adverse weather, the 1989-1990 carryover portion of Forest Management Unit 89 was not photographed. This 2,470 km^2 area will be deferred, for the second time, until next year.

Forest Cover Mapping and Photointerpretation

Forest Cover Mapping was 83 percent completed (13,180 km^2) in the planned portion of the Nelson River forest section in Northern Manitoba. Mapping and photointerpretation activities were limited by the aerial photography contract, which was not completed. In addition, photointerpreters were assigned to assist in analysis and area mapping supervision for the 1989 and 1990 wildfires. Of the planned 15,950 km^2 only 13,750 km^2, of photointerpretation were completed during the year in Forest Management Units 66 and portions of 82 and 89.

Forest Resource Surveys

a) Resource Inventory

Field personnel concentrated mostly on Growth and Yield activities for the year. A small number of temporary sample plots (192) were established in Forest Management Unit 61 which will be added to the Stand-Stock Volume Table for the Highrock Forest Section.

b) Growth and Yield

Growth and Yield activity continued in fourteen (14) Forest Management Units throughout the Province. Sixty-nine (69) permanent sample plots containing 14,333 trees were established in the Mountain, Interlake, Highrock, Churchill River and Nelson River forest sections and eighteen (18) permanent plots, containing 266 trees, established five (5) years previously, were remeasured in the Interlake forest section. In addition 154 trees were measured for stem analysis, adjacent to the permanent sample plot locations.

Table 1: Forest inventory projects, 1990-1991.

Activity	Planned Area km^2	Actual Area km^2
Aerial Photography	12,600	10,130
Phototyping	15,950	12,040
Forest Cover Mapping	15,950	13,180
Air Photo Interpretation	15,950	13,750
Area Compilation (FORIST Library)	35,400	33,250
Forest Inventory Reports	35,400	0

Forest Geographic Information System (FORIST)

The loading of new and recent available forest cover information into computer storage continued. A second shift of digitizing workstation operators worked for approximately three (3) months. Over 1,930 forest cover map sheets each covering an area of 9,500 hectares or 95 km^2 have now been entered into the "library" storage area of the Geographic Information System (GIS) of which 334 were completed during the year. Forest Management Units, in the Nelson River and Highrock forest sections, which were affected by severe 1989 wildfire occurrences have had both area and volume reports processed, in preparation for a revision to the annual allowable cut.

Computer program development to meet forestry regional office requirements continues with the regional entry of timber sale locations, depletion and area change information into the data base.

Wildfire Management

The wildfire damage and loss reports for both 1989-1990 and 1990-1991 fiscal year were completed during the year and are summarized in Table 2.

Table 2: Wildfire damage in 1989-1990 and 1990-1991.

	Fire Year	
	1989-1990	1990-1991
Man Caused Fires	513.	288.
Lightning Caused Fires	713.	282.
Total number of Fires	1,226.	570.
Area Burned - Forest Zone (ha)	2,636,140.	15,100.
Total Province (ha)	3,567,900.	16,400.
Merchantable Volume Lost		
Forest Zone	68,076,300. m^3	226,400. m^3
Total Province	75,039,340. m^3	235,300. m^3

Private Land Forestry

This program undertook approximately fifty-four (54) on site farm woodlot visits, hosted six (6) public woodlot interest meetings and participated in another five (5) meetings as one of a number of guest speakers. Results of over eleven hundred (1,100) landowners surveyed in four (4) widely separated municipalities were published in conjunction with the Rural Development Institute at Brandon University. It is a forty-five (45) page report entitled "A Survey of Land Owners in Manitoba Regarding Establishment of Private Land Forestry Management Programs" and is now available upon request. Five (5) of the above noted woodlot interest meeting were

keyed into the four (4) municipalities which were surveyed.

Other project included: placement of the Great American Woodlot thirteen (13) part video series in the Rural Development Institute at Brandon University and a second set at the Swan Valley Regional Secondary School forest library (available for loan to the general public), assistance for a student's Master degree practicum on a proposed woodlot program for Manitoba, preliminary discussions for developing a private land forest management program to be included under the next Federal/Provincial Forestry Agreement, and preparation of four (4) woodlot proposals for the Sustainable Development Unit to consider funding.

In addition to helping the Manitoba Christmas Tree Growers Association with their annual meeting, thirty-nine (39) formal requests for Christmas tree growing information were actioned. The Winnipeg Christmas Tree market was again surveyed with a report to follow. Assistance or information was provided to the three (3) groups undertaking a Christmas Tree disposal projects in Winnipeg for the first time.

Two (2) new product thrusts were initiated this year. One project involved the growing of Shiitake and Oyster mushrooms on logs in a woodlot. Trial mushroom spawn was acquired for six (6) investigative projects for early the following year. The other project involved investigating the potential to revive maple syrup producing interest. By year end the tapping of Manitoba Maple by the Trappist Monks south of Holland and the community maple syrup producing project by the village of St. Pierre-Jolys had been on-site visited.

Timber Management and Industrial Development

The Timber Management and Industrial Development component of the Forest Management Section is concerned with all aspects of timber use, royalty or stumpage charges and wood measurement which directly involve the provincial forest industry.

This past year was especially grim for the forest industry as product prices posted new lows in the late fall/early winter period. With the recession in full swing and the strong Canadian dollar, the market outlook for the first half of 1991 was also bleak. By the end of March the only hopeful sign was the recovery of some low lumber prices.

The recessionary trend was also reflected in results of the timber dues monitoring and adjustment program, as preliminary results indicate their will be little change in rates for the nest year.

Despite the slow economy overall, two significant industrial developments occurred. A new company called Reynolds Wood Products Ltd. (a tongue depressor and stir stick manufacturing facility in the Whitemouth area) was announced and Spruce Products Ltd. commenced field production of wood pulp chips at their Swan River operation. These chips, which utilize the full tree, will be sold to Repap Inc.

The scaling (or wood measurement) program has initiated a check scaling program at Repap for both weight scaling and field chip conversions (including specific gravity determinations by the departmental laboratory). Additional stackwood training was provided by the scaling program at a local Winnipeg plant, and a Provincial Chief Scalers' meeting was held for both the industry and regional staff. An adjustment procedure was approved for underlength wood buried in

stackwood piles and ten of thirteen candidates successfully completed this years scaling licence certification course.

Industrial development activities included: visits to eight (8) sawmills in the south and eastern regions by the Forintek small mill representative, arranging five (5) chain saw operator/maintenance courses throughout the province (in conjunction with Husqvarna), assisting with a proposal to use fire damaged timber from recent forest fires, pulpwood log reclamation from the Winnipeg River at Pine Falls, investigating facilities for a regional forestry trade show, coordinating Branch representation for the 10th consecutive year at North America's largest career symposium, and meeting with Minnesota timber utilization staff to discuss industry developments in both Manitoba and Minnesota.

SILVICULTURE

Introduction

Silviculture refers to the art and science of growing trees. It involves the renewal of harvested or burned forests and the subsequent tending of the forest crop.

The goal of the silviculture program is to regenerate depleted forests and to improve the productivity of the regenerated forest. This will increase the Annual Allowable Cut and ensure long term economic and environmental benefits to Manitobans.

The role of the Manitoba Forestry Branch Silviculture Section is to co-ordinate Manitoba's silviculture program and ensure that provincial silvicultural standards are achieved in the most cost efficient manner. The Section has three major subdivisions: Clearwater Forest Nursery at The Pas, Pineland Forest Nursery at Hadashville and the Silviculture and Tree Improvement Section coordinated out of Winnipeg.

Silvicultural field programs such as site preparation, direct seeding, planting and stand tending are implemented on forest lands in Manitoba by the Forestry Branch Operations Section and industry (Repap Manitoba Inc. and Abitibi-Price Inc.). Industry is responsible for forest renewal activities on burned areas and areas that they have harvested within their Forest Management Licences (FML). The companies pay for these activities through their Forest Renewal Trust Fund. This fund has been established from the forest renewal charge which is levied on the companies as a separate fee, in addition to the regular stumpage charge, for all wood harvested within their FMLs.

Field Programs

The Forestry Branch and forest industry carried out regeneration treatments on 8,904 ha of forest land as part of the provincial reforestation effort. The majority of the area was planted, with seeding and scarification to promote natural regeneration performed on the balance (Figure 1).

Reforestation treatments were carried on 8,551 ha of recent cutover. Based on the volume of wood cut in 1989-1990 an estimated 12,200 ha were harvested. Therefore, an amount equal to approximately 70% (8,551 ha) of this area was treated for reforestation in 1990 and the remaining 30% was left to regenerate naturally or be treated in subsequent years.

In addition to these treatments 353 ha of area which did not achieve adequate stocking were retreated by planting (Table 3).

The level of tree planting in Manitoba has remained relatively constant with approximately 13.5 million seedlings planted annually over the past four years, except for 1988-1989 when 15.7 million trees were planted.

Scarification to promote natural regeneration of jack pine increased in 1990-1991, occurring on 2,622 ha. Sites are mechanically disturbed to prepare a receptive seedbed and redistribute cone bearing slash. This treatment has proven to be a cost effective and successful method of regenerating jack pine on specific sites.

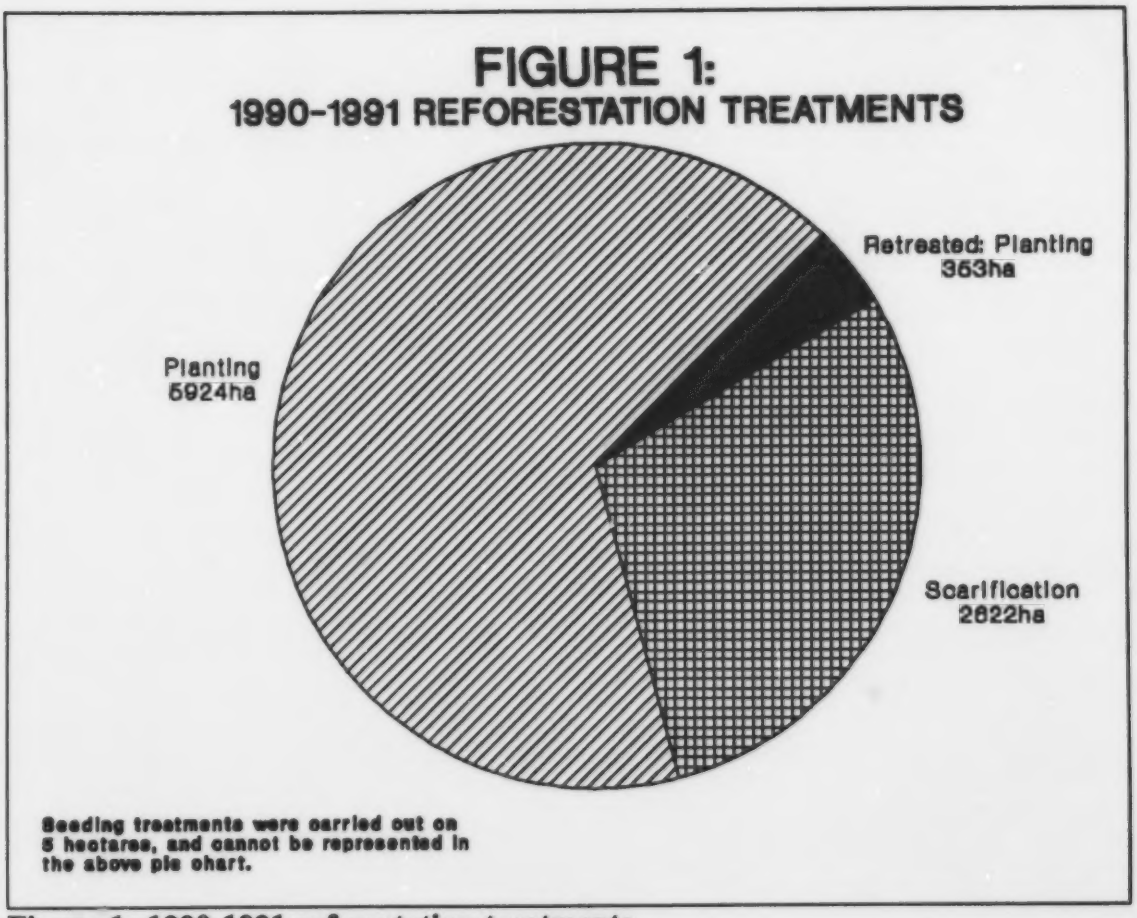


Figure 1: 1990-1991 reforestation treatments.

Numerous methods were used by the Forestry Branch and industry to prepare cutover sites for the tree planting program. The most frequently used methods in descending order are Bracké patch scarifier; various disc and power trenchers; Ripper tooth; dozer and shearblade; chains and barrels; herbicide ground application; and burning of windrows. The Alberta Forest Service loaned two of its Bracké scarifiers to the Forestry Branch to assist with the completion of the site preparation contracts in the Western Region.

Pineland Provincial Forest Nursery

Pineland Provincial Forest Nursery shipped 4.1 million bareroot seedlings, 3.0 million frozen container seedlings and 2.0 million current crop container seedlings during the 1990 planting season.

During the fall 1.5 million bareroot seedlings were lifted and packaged for frozen overwintered storage. In addition 3.3 million container stock and 529,000 greenhouse transplant stock were packaged and placed in frozen storage. As well 1.5 million container seedlings were shipped from Clearwater Nursery for frozen storage.

Table 3: 1990-1991 forest renewal treatments

1990-1991 Forest Renewal Activities	Manitoba Forestry Branch	Abitibi-Price Inc.	Repap Manitoba Inc.	Total
Site Preparation				
Mechanical (ha)	3,216	1,153	3,654	8,733
Chemical (ha)	30	25		55
Renewal				
Trees Planted (1000s)				
Container stock	2,622	1,081	5,318	9,021
Bareroot stock	3,239	692		3,931
Total number of Trees (1000s)	5,861	1,773	5,318	12,952
Hectares planted	2,459	915	2,550	5,924
Hectares seeded	5			5
Hectares Scarified for Natural Regen	1,351	—	1,271	2,622
Total Hectare Treated	3,815	915	3,821	8,551
Re-Treatments				
Trees Planted (1000s)	564	67		631
Hectares replanted	318	35		353
Stand Tending				
Hectares Herbicided	256			256
Hectares Thinned		11		11
Cone Collections (hectolitres)				
Jack Pine	171			171
Red Pine	5			5
Black Spruce	119	7		126
White Spruce	2	—		2
Total Collected (hl)	297	7		304

In early 1991, a total of 276,000 frozen bareroot seedlings and 1.9 million frozen container seedlings were shipped for snow caches in several locations throughout the province.

Transplanting is commonly used in the tree production process as a method of transferring greenhouse stock to nursery fields to facilitate optimal growth. This included 4.8 million greenhouse seedlings and 530,000 bareroot transplants. Scots Pine was included for the first time with 33,000 bareroot seedlings transplanted in the 1990 program.

Pineland also produced stock for the woodlot owners, Christmas tree growers, the Parks Branch and several special interest groups.

A black spruce clonal orchard was established at the nursery for the Provincial Tree Improvement Program.

Root pruning (undercutting) and wrenching trials were conducted on 2+0 jack pine. Several

treatments were used in the trials to determine the best timing and intensity of undercutting and wrenching. The main objectives of undercutting and wrenching, are to reduce top growth, increase fibrous root growth, reduce top-root ratios, and improve drought hardiness after outplanting.

A holding area for current crop container stock was completed in 1990. The holding area can accommodate up to 14 greenhouse crops at any one time. This allowed for the conversion of the remaining shade frames to coldframes to help meet the growing demand for container stock and greenhouse transplant stock.

Tensiometers were used to help determine the best timing for irrigation in all 2+0, 3+0, first year and second year transplant fields.

Seed extraction for the 1990-1991 seed year included a total of 161.30 kg of seed cleaned from 320.0 hectolitres of cones.

Clearwater Provincial Forest Nursery

Clearwater Provincial Forest Nursery shipped 5.4 million containerized seedlings to Repap Manitoba Inc. and the (Forestry Branch) Northern Region. These crops were produced using the 20 greenhouses at the nursery. All containerized stock was grown in Can Am multipot containers.

To meet the projected 5.4 million seedling requirement in the spring of 1991, 20 greenhouses were sown in June 1989 for an overwintered crop. Nine of these overwinter crops were packaged at Clearwater Nursery in November, 1990. A total of 1.5 million packaged seedlings were shipped from Clearwater Nursery to Pineland Nursery for cold storage. An additional 10 greenhouses were sown in January, 1990 to produce the current year's planting of 5.4 million seedlings. The projection for 1991 is 6.8 million seedlings.

An infra red propane heating system was installed in 2 existing greenhouses at Clearwater Nursery. This was done to replace burned out wood burning furnaces.

Tree Improvement Program

The goal of the tree improvement program is to increase the yield and quality of wood produced from plantations through the development of genetically improved planting stock. A large number of "plus" trees, which appear to be superior due to their above-average growth and excellent stem form, are selected. The seed from each tree is considered a family and is used to establish family tests and seed orchards. The family tests are used to determine which trees are superior, therefore should be left in the seed orchard to produce genetically improved seed.

A jack pine tree improvement program was initiated in Manitoba by Forestry Canada over twenty years ago. During the past five years the Manitoba Forestry Branch has worked with Forestry Canada to establish seed orchards throughout the Province. In 1989 the management of these orchards became the responsibility of the Forestry Branch. These orchards are expected to begin producing seed in the next three to four years.

The forest industry has recognized the program's potential to increase the productivity of future forests and as a result both Abitibi-Price Inc. and Repap Manitoba Inc. have established co-operative tree improvement programs with the Forestry Branch. The achievements of these and other tree improvement programs in Manitoba are shown in Table 4.

4. Tree improvement program update to 1990-1991

Species	# Plus Breeding Zone	Trees Selected	Family Tests Established	Seed Orchards Established	Clone Bank
Jack Pine	Eastern	226	4 sites 4.1 ha	6.0 ha	0.2 ha
	Western	244	1 site 1.0 ha	0	
	Interlake	320		4.0 ha	
	Northern	320		4.0 ha	
Black Spruce	Southeast	450	2 sites 10.1 ha	0	
	Lk.Wpg.East	450	3 sites 9.6 ha	7.5 ha	0.7 ha
	Interlake	171		(4.0 ha cleared)	
	Sask.River	450	3 sites 10.8 ha	(11.0 ha cleared)	
White Spruce	Mountain	380	4 sites 8.1 ha	(5.0 ha cleared)	
TOTAL		3,011	17 sites 43.7 ha	21.5 ha	0.9 ha

In 1990-1991 the following activities occurred:

- A breeding program to provide control-pollinated seed for expanding the Hillside Pedigreed Jack Pine Orchard, was initiated in the Eastern Breeding District family tests. A number of the crosses could not be completed due to insufficient flowers and damaged pollination bags.

- A lack of precipitation in 1989 resulted in severe winter desiccation damage to the black spruce family test plantations in the Southeast Breeding Zone. Survival dropped from 98% after two years to 68%. To offset the damage, replications were refilled from on-site spares and ten new replications will be established in 1992.

- A 7.5 ha black spruce seedling seed orchard for the Abitibi-Price/Manitoba Forestry Branch co-operative program was planted in the Brightstone Provincial Forest.

- Two 2 ha mass selection seed orchards were site prepared in the Interlake Region. The sites by Lake St. George and Mantago Lake will be planted with black spruce in 1991.

- Three 3.6 ha black spruce family test sites were planted by Repap Manitoba Inc. and the Forestry Branch as a part of their co-operative program in the Saskatchewan River Breeding Zone near The Pas. An 11 ha seed orchard site has been prepared for planting in 1991.

Silviculture Surveys Program

Regeneration surveys are the initial inventory carried out on an area following harvesting, fire or reforestation treatment. The purpose of the regeneration survey is to document the presence of softwood and hardwood regeneration; it also provides a comprehensive assessment of seedling quantity, quality and spatial distribution. The information collected by regeneration surveys is an essential component of a sound forest management strategy.

Most areas are surveyed between three and seven years following depletion to enable the detection of seedlings which meet established age and height standards. Surveys are conducted in Manitoba by the Forestry Branch Silviculture Section and by representatives of Abitibi-Price Inc. and Repap Manitoba Inc. on their respective licence areas. Silviculture section staff also conduct "check surveys" on those surveys performed by the forest industry in order to ensure provincial survey methods are being applied properly. Certificates of Reforestation were awarded to Abitibi-Price Inc. and Repap Manitoba Inc. for regenerating for 849.3 ha and 1994.8 ha (respectively) to provincial forest regeneration standards.

In 1990 forest regeneration surveys were conducted on a total of 13,784 ha. The Forestry Branch surveyed 7,290 ha while forest industry, Repap Manitoba Inc. and Abitibi-Price Inc. accounted for 6,494 ha. Each company analyses the results of their own surveys while the Silviculture Section analyses the Forestry Branch results and reviews the forest industry reports. Areas identified as not satisfactorily regenerated (NSR) are brought to the attention of forest managers and are given consideration for further renewal efforts.

The analysis of regeneration survey results has been refined in recent years to include the amount of area regenerated to softwood, mixedwood and hardwood covertypes. The 1990 Regeneration Survey Results report recommended that the interim provincial stocking standards be revised further. The revision included four regeneration standards that correspond to the four covertype classifications of the Manitoba Forest Inventory.

An analysis of five years of data collected on almost 33,000 ha between 1986-1990 was also completed in 1990. The Forest Regeneration Survey Results Five Year Analysis revealed that approximately 70% of the area surveyed was satisfactorily regenerated (SR) to provincial regeneration standards. The analysis confirmed that softwood sites account for most of the NSR area and also revealed to what forest covertypes harvested forests were regenerating (Figure 2).

Figure 2: Forest development.

Further analysis showed that almost 90% of the total area was stocked to a level greater than or equal to 55% (Figure 3).

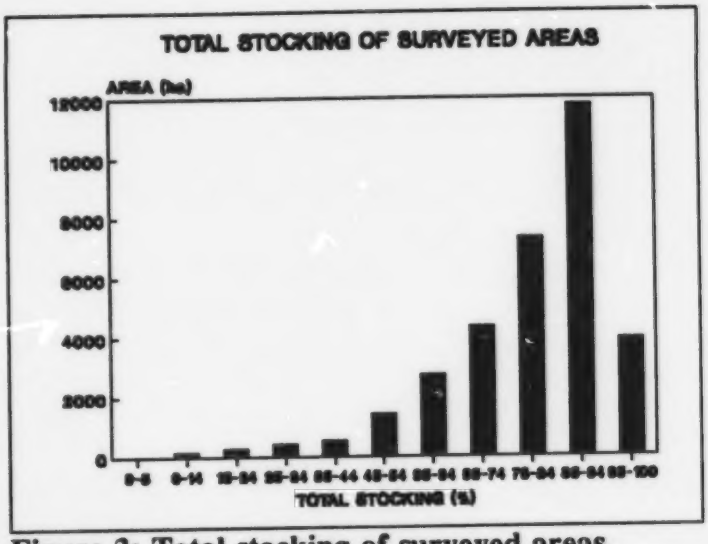


Figure 3: Total stocking of surveyed areas.

Other Silviculture Section Programs

The Northern Manitoba Field Trial of Vision for Conifer Release was established as a co-operative venture between the Forestry Branch Silviculture Section and Repap Manitoba Inc. The long-term field trial will determine for each of the three major coniferous species in Manitoba (white spruce, black spruce, and jack pine) the best time to release the coniferous crop from trembling aspen competition.

The Regeneration Performance Assessment program which studies the growth of forest regeneration was reviewed to ensure program objectives would be efficiently achieved. The number of established plots was pared to approximately 600 in order to obtain the necessary data from as few plots as required. The program will undergo further revision in 1991 to address data collection procedures.

The development of a Silviculture Manual for Manitoba continued in 1990-1991. The main purpose of the manual is to provide operational guidelines to field staff on various aspects of silviculture practices in Manitoba. The first three chapters on *Silviculture in Manitoba* and *Administration, Policies and Contracts* and *Silviculture Practices and Operations* have been completed and will be published in 1991-1992. Two reports on direct seeding were also prepared in 1990-1991.

Sioux-McDonald Seedling Contract

The Province of Manitoba contracted Sioux McDonald Ltd. to produce 1,000,000 black spruce seedlings for reforestation programs. Seedling production commenced in January 1990 and seedlings were shipped during June and July 1990. The 935,846 seedlings delivered met contract specifications and payment of $187,369.20 came from the Environmental Innovations Fund.

FOREST PROTECTION

OBJECTIVE #1: ***To Prevent Widespread Tree Mortality and Timber Losses in Forest Stands and to Maintain Quality Forest Cover in High Use Recreational Areas.***

Spruce Budworm

Spruce Budworm, (*Choristoneura fumiferana*), has historically been a moderate to severe defoliator of the white spruce/balsam fir component of Manitoba's forests. Populations have fluctuated greatly over the last century and the present outbreak which began in the early 1980's is still significant in size and intensity. Suppression of budworm populations below economic thresholds (to prevent 50% or more defoliation) is carried out to protect timber resources and prevent mortality of trees in parks and cottage areas. A spruce budworm suppression program was implemented over an area of 5,674 hectares of high use recreational land in Nopiming Provincial Park (campgrounds and cottage subdivisions) and high value timber in the Abitibi-Price Forest Management Licence (FML).

The pre-spray survey for spruce budworm occurred from June 4 to June 7, 1990 confirming the necessity to spray and the appropriate timing of application. Pre-spray population levels averaged 12 larvae per 45 cm of branch. These levels have the potential to cause moderate to severe defoliation.

The biological bacterial insecticide, *Bacillus thuringiensis*, (Futura XLV) was aerially applied undiluted at 30 BIU per hectare (single application) at a rate of 2.03 litres per hectare on 3,050 hectares and also in a double application of 20 BIU per hectare (volume was 1.35 litres X 2 = 2.70 litres per hectare) on an area of 2,624 hectares. The application was carried out between June 12 and 18, 1990. Weather conditions were generally favourable with temperatures ranging from 2 to 21° C, relative humidity in the 58 to 95% range and light winds up to 13 kph.

The post-application survey and efficacy assessment was carried out June 19 to 21, 1990. Defoliation assessments were done in September 1990. Larval reduction due to insecticide (using Abbott's formula) was 32.9% for the double application and 0% for the single application. No appreciable foliage protection was achieved. However, there was noticeable population suppression in egg mass densities which indicated that the 1991 larval populations would be 2 to 3 times higher in the unsprayed control areas versus the 1990 treatment area. The previously described egg mass surveys were carried out in August 1990 to predict spruce budworm defoliation for 1991 in Whiteshell and Nopiming Provincial Parks and in the Abitibi-Price FML area. Light to moderate defoliation is predicted for the treated areas whereas moderate to severe defoliation is predicted for the untreated areas. Despite less than hoped for larval reductions in the last several years of Bt budworm suppression programs there now exists a definite trend toward considerably reduced spruce budworm populations in areas within the provincial management program adjacent to untreated areas.

Jack Pine Budworm

Jack pine budworm, (*Choristoneura pinus pinus*), is a major defoliator of jack pine in Manitoba. This pest consumes mostly new growth. After two to three years of severe defoliation, jack pine

budworm can cause top-kill, reduced vigour, growth loss and tree mortality. Large areas of pine can be infested as occurred in 1985 when one million hectares were defoliated in Manitoba.

Unlike spruce budworm, populations of jack pine budworm tend to rise and collapse suddenly. Epidemics generally recur every seven to eight years and last for two to four years. Monitoring jack pine budworm populations has traditionally been by egg mass survey. This method, although reasonably accurate during the rise and peak phases of an outbreak has been less accurate in predicting population collapses and endemic population fluctuations to epidemic levels. Pheromone traps are being tested as a more indicative method of monitoring endemic populations. This survey method has been experimentally field tested at 12 locations throughout the range of jack pine in Manitoba since the collapse of the last epidemic in 1985.

As in 1989, the 0.03 microgram concentration of the pheromone lure and two trap types (saturating Pherocon 1C and non-saturating Multipher) were tested in 1990. Tree branches were collected at each location and assessed for defoliation, egg masses and staminate buds. Defoliation and egg mass numbers have remained at a low level throughout the province.

Male jack pine budworm moth captures decreased from 1985 to 1987, and were on the increase until 1990. Moth captures dropped over 50% from 1989 numbers. It is uncertain whether this decrease is actual or artificial as the batch of PVC used in making the lures was changed from previous years. Table 5 shows male moth captures for the 0.03 microgram concentration per location for the Pherocon 1C traps. In addition to the permanent locations, pheromone traps were established at eight jack pine budworm monitoring sites in the Sandilands Provincial Forest. Two of these sites captured much higher than average moth numbers for the area. Results from the branch assessments of all eight sites showed some light defoliation and three egg masses were found.

Pest assessment of Permanent Sample Plots (PSPs)

Since 1986 the Silviculture section of the Manitoba Forestry branch has situated permanent sample plots in recently established plantations of the major commercial tree species. Up to 45 plots are being maintained per species, taking into account the different types of planting techniques and silvicultural site preparation methods. Forest Protection has initiated a program on these sites to examine the relationship between pest damage and growth and yield results.

The PSPs are circular (50 square meters) arranged in a grid pattern across part of each plantation, at a density of one plot per hectare for the selected areas. Pest damage and causal agents are assessed every three years of growth from about ages three to 21. In 1990, the 1986 PSPs were assessed. These included 25 plantations (210 PSPs) with White and Black spruce, and Red and Jack pine as the primary species. To assess pest occurrence, data is entered into a program developed by Silvacom Ltd. in conjunction with Forestry Canada and the Province of Manitoba. The PSP program is still in the initial phase and long term data bases and analysis will be developed to better understand the growth and survival of young plantations.

Renewed Forest Pest Survey

To date, 1987-1990, 133 renewed forest stands covering 4,685 hectares have been surveyed in the Province of Manitoba. In 1990, the surveyed trees ranged in age from 9 to 54 years. In

Table 5: Male jack pine budworm moth captures with Pherocon 1C traps (0.03 microgram concentration).

Location	Total Number of Moths Captured					
	1985	1986	1987	1988	1989	1990
Sandilands Prov. Forest	208	21	5	60	44	8
Spruce Woods Prov. Park	558	184	184	123	226	112
Whiteshell Prov. Park	50	48	18	28[a]	19	0
Belair Prov. Forest	38	43	15	47	13	0
Nopiming Prov. Park	133	39	5	44	40	4
St. Martins	559	64	2	2	16	1
Porcupine Mtn. Prov. Forest	186	7	0	3	7	6
Moose Lake	63	2	0	3	2	17
Reed Lake	46	4	0	1	4	2
Kississing	76	4	0	5	15	20
Thompson/Wabowden	31	2	0	7[b]	5	0
Lynn Lake	112	1	0	0	0[c]	-
Grand Rapids	-	-	-	-	-	9
TOTALS	2060	419	229	323	391	179

a. 50 % of traps damaged
b. Plot relocated to Wabowden in 1988
c. Plot destroyed by fire, only 2 traps recovered, plot moved to Grand Rapids.

1990, 57 renewed stands, (2,000 hectares), were surveyed in the southeastern and eastern regions of Manitoba. In the southeastern region, the survey covered 9 red pine stands (208 ha), 8 jack pine stands (310 ha), 6 scots pine stands (57 ha), 9 white spruce stands (300 ha) and 17 mixed wood stands (533 ha). At the end of 1990 a three year, 10% sample survey of renewed forests in the southeastern region had been completed. In the western region crews surveyed 3 white spruce plantations (229 ha), 2 jack pine stands (176 ha) and 4 naturally regenerated mixed stands (187 ha).

In the southeast region several jack pine stands (both machine and hand planted) had high levels of leaning trees with j-roots. Other significant problems included western gall rust (*Endocaronartium harknessi*), topkill, armillaria root rot (*Armillaria sp*) and blowdown. Main stem cankering on red pine resulted in loss of main stem dominance, top kill and large stand

openings. White spruce stands often showed poor growth related to unsuitable site conditions. Moderate spruce budworm defoliation occurred on white spruce in the Whiteshell area.

In the western region severe rabbit browse occurred in many white spruce stands, many of which will require replanting. Hail damage caused leader and top kill in Siberian larch and Jack pine. Other problems on jack pine included mainstem girdling from the Warren root collar weevil (*Hylobius warrenii*) on natural regeneration. Some hand planted stands showed leaning conditions and evidence of dwarf mistletoe (*Arceuthobium americanum*). In marketable stands of trembling aspen hypoxylon canker (*Hypoxylon mammatum*) and large aspen tortrix (*Choristoneura conflicta*) were the most commonly encountered pest problems.

Western Gall Rust

Western gall rust (*Endocronartium harknessii*) is a disease of jack pine that can cause significant volume loss, especially when occurring in young plantations. Galls generally form on the main stem of seedlings causing reduced growth, deformities and weakening of the stem. Jack pine is presently 23% of Manitoba's forestry planting stock and is likely to increase to 28% by the year 2000. Forestry Canada and Manitoba Natural Resources, Forestry Branch have established a pedigreed seed orchard from selected superior jack pine families in eastern and southeastern Manitoba. From this orchard, future seed orchards will be developed and provide jack pine seed requirements for forest renewal programs in the eastern half of the province. As part of the jack pine breeding program, a second study was developed between Forestry Canada and Manitoba Natural Resources, Forestry Branch to evaluate these superior families and their offspring for susceptibility to western gall rust.

Cones were collected during the 1990 spring season from field-resistant and field susceptible families in the Marchand test plantation. Seed was extracted, grown and the young seedlings were then inoculated with western gall rust spores from Manitoba sources. The inoculation experiments occurred at Forestry Canada, Edmonton, Alberta. Another ongoing trial was the inoculation of young seedlings from the original parents with spores from several different sources. Final assessment of the seedlings' reaction to these inoculations will be completed at a later date. The rating criteria used for gall rust infection was developed from inoculation trials done during 1988 and 1989.

Controlled crosses were conducted between field-resistant and field-susceptible families at the Belair family test plantation. Crosses between selected families will occur in 1991 at the other three family test plantations. Information gathered on susceptibility to western gall rust will be used to evaluate the families in the current pedigreed seed orchard and to rank families in the provinces second generation program.

Western Gall Rust Thinning Program

In 1985, approximately 150 hectares of 24 year old jack pine was thinned near Dragline Lake in the Duck Mountain Provincial Forest. The incidence of gall rust is high in this area, with approximately 50% of the trees having main stem galls prior to thinning. Tree spacing, growth and form were the major thinning criteria. Little or no consideration was given to presence of rust. Consequently, main stem infections are still prevalent (approx. 40%) after thinning. Elongate (often 1 to 2 meters in length) flattened cankers are frequently associated with main

stem galls. These galls/cankers have the potential to cause growth loss, deformity and girdling or breakage of the main stem. Considering the stand has been thinned to optimum stocking for this age class, a significant reduction of stems per hectare would translate into substantial volume loss at rotation.

A study was initiated to monitor the impact of main stem rust infection on stand productivity and to determine if selective thinning using rust as the major criteria could be carried out without leaving the stand understocked. In 1990, two 400 metre square plots were established in both the thinned area and a nearby heavily infected unthinned stand of the same age. An area 0.25 hectares in size was thinned in this stand using main stem gall rust as a major thinning criteria. Two additional 400 square metre plots were also established in the unthinned stand. Tree growth measurements, vigour assessments and main stem infection severity ratings are to be done in all plots. Over time, stand productivity will be compared between no treatment, thinning without using rust as a criteria and thinning where rust infection is one of the major criteria.

Red Pine Dieback

In 1988, during routine pest surveys in renewed forests, a tip dieback condition was discovered in a 32 year old Red pine plantation in the Sandilands Provincial Forest of southeastern Manitoba. The condition tended to occur in fairly discrete infection centres with a gradient of lightly infected trees on the periphery to chronic infection towards the interior. Chronically infected trees are often stunted, have lost their main stem dominance, have significant stem taper and become bush-like in their growth habit. There is no noticeable mortality associated with this condition as infected trees remain quite vigorous. Damage appears to be mainly growth loss and deformity.

In May 1990, three permanent plots (900 square metres each) each were established to monitor the impact and spread of this condition. Initial height measurements showed differences between infected trees and those having no or slight infection. The average height of trees having chronic infection was 5.2 meters (n=52 trees), while uninfected trees averaged 7.6 meters (n=152 trees). The level of infestation in each of the plots was 56, 49 and 30 percent. Two of the plots were placed well within the infection centres and the third was placed at the periphery of a centre.

In attempt to determine the causal organism, cloth sleeves were securely placed on groups of branches at three different times during the growing season (mid-June, late June and mid-July). In early August, bud condition was compared between sleeved and paired unsleeved branches. Bud mortality averaged 5% on branches which were sleeved in mid and late June, compared with 25% bud mortality on unsleeved branches. On those branches which were sleeved in mid July, the bud mortality was equal to that of the unsleeved branches (approximately 40%). The sleeves placed on branches in mid and late June effectively excluded infection from occurring.

By early August 1990, symptoms became visible on dying shoots (tips of the current shoots browned off). Needle loss and bud kill are associated with the tip browning. Samples from dead buds and browned tips were then cultured. The cultures derived from the samples appeared to be very homogeneous and additional samples from other plantations have been collected for identification. This project is still in progress.

Stem Cankers in Red and Jack Pine

In 1988, during routine pest surveys in the Sandilands Provincial Forest, severe stem cankering was detected in jack pine (20 to 22 years old) and red pine plantations (18 to 32 years old). On both species the cankered portions of the stem are often flattened and/or twisted. The bark usually remains in tact concealing the canker. Cankers range in length from several centimetres to two meters. The cankers eventually cause girdling and result in top kill or tree mortality. Substantial mortality centres have developed in some areas indicating the disease has been present for a number of years. In the oldest of those surveyed (32 year old red pine) infection centres have coalesced resulting in substantial volume loss.

In May 1990, permanent plots (two 400 square metre plots in 22 year old jack pine and two 900 square metre plots in 32 year old red pine) were established within infection centres to monitor the spread and impact of the stem cankering. The variation in plot size was due to considerably greater density in jack pine plantations. Within the jack pine plots the percentage of trees having main stem cankers is 19% and 51%, while in the red pine it is 35% and 44%.

A number of canker samples were collected from all plots and culturing and isolation of the causal agent(s) in jack pine is near completion. Ten isolates have been selected from jack pine which will be tested as possible causal organisms. The culturing of red pine canker samples is still in progress. Greenhouse inoculation of seedlings and field inoculations of 10 to 20 year trees is planned for both host species in 1991.

Armillaria Root Rot

As part of the jack pine dwarf mistletoe management program, red pine, a non-host species was planted on 1,300 ha of jack pine cutovers in the Belair Provincial Forest during the 1970s. The young red pine stands have experienced some mortality due to drought and Armillaria root rot (*Armillaria obscura*). In 1983, permanent sample plots were established in five root rot infection centres to monitor Armillaria activity. The increase in tree mortality due to Armillaria over the past five years in the sample plots has been 17%, 14%, 10%, 3% and 6% respectively. Total annual tree mortality to date within each plot has been 41%, 35%, 19%, 15% and 19% respectively. Armillaria activity appeared to be at a low level in the infection centres during 1990. Three plots showed no increase in mortality, while two plots had a 1% disease increase.

The presence of Armillaria root rot has also been monitored since 1983 in thinned 40 to 50 year old red pine plantations in southeastern Manitoba. Both stumps and standing trees have been included in the assessment. To date, Armillaria has only been detected in one stump and is absent from standing red pine. There is no current evidence to suggest that thinning enhances Armillaria infection in red pine plantations.

Pine Root Collar Weevil

Scots pine were planted in 1971 in the Grand Beach area of eastern Manitoba as part of a jack pine mistletoe management program. Initial Scots pine survival was excellent (greater than 80%) and growth was approximately 25 cm per year once trees became established. Beginning in 1981, significant chlorosis and mortality of trees occurred due to root girdling by the pine root collar weevil, *Hylobius radicis*. Permanent sample plots were established in 1983 in four affected

plantations to monitor mortality levels due to weevil feeding. Mortality rates in the four plots increased by 37.0%, 9.8%, 25.8% and 27.5% between 1983 and 1989. Total mortality due to weevil feeding in the four plots was 43.3%, 14.9%, 30.9% and 41.8% for the period 1983 to 1989.

The high susceptibility of Scots pine to root collar weevil has made it unsuitable for commercial forestry planting within the range of this insect in Manitoba. Scots pine is a major Christmas tree species grown in Manitoba and should not be planted in the proximity of jack pine forests (the natural habitat of the root collar weevil).

Fire Management

In Manitoba forest fires consume on average 175,000 hectares annually, worth an estimated $25 million in potential timber resources. As part of the Forest Protection mandate, the development of new fire management techniques and methodologies has been incorporated into the Forest Protection overall goals and objectives.

Forest Protection has developed a mandate to assist the Regional Services Branch - Fire Program in developing and delivery of new fire suppression, prediction and behaviour technologies. The first of these is the installation and delivery of Intelligent Fire Management Information System (IFMIS). This is a computer based software program developed by Forestry Canada. The program is designed to aid fire control officers and managers in making daily prediction of fire activity and determining appropriate action for fire suppression and pre-planning. This program assists with many parameters, including deployment of equipment and manpower, weather prediction, fire behaviour and value at risk.

Other programs in development are production of a provincial fire history and a long term comprehensive program to examine values at risk using a multivalue system (e.g. parks, recreation, wildlife, forestry, etc.). These data will be complied and analyzed to produce in-depth resource value assessments for all areas of the province currently protected within the fire program.

OBJECTIVE #2: Dutch Elm Disease Integrated Management Program

The objective of the Dutch Elm Disease (DED) program is to manage the loss of high value urban elm trees at less than two percent annually. The DED program uses an integrated approach to minimize the effects of DED on Manitoba's urban forests.

During the 1990 provincial summer surveillance season, approximately 14,800 elms were marked in and around urban and rural municipalities as hazard trees or as having DED. Many of these hazard trees were dead as a result of DED; all are potential breeding sites for disease spreading elm bark beetles. Control efforts were once again concentrated on elms in and around the 53 cost-sharing agreement communities (CSAs). Elm trees outside the borders of CSAs in the central and eastern regions of Manitoba were not included in the provincial DED integrated management program due to the impracticability and expense of implementing control procedures in wild stands. Within the CSA communities management efforts concentrated on sanitation, pruning, public education and liaison and basal insecticide spraying with chlorpyrifos for the control of overwintering elm bark beetles. The Forestry Branch is wholly responsible for the

survey and removal of diseased, dead and decadent (hazard) elm trees within the CSA communities.

Severe drought conditions increased the stress on elm trees during 1990. This stress was reflected in a general increase in DED severity in all jurisdictions across the province. The northwestern front of the disease moved into the town of Dauphin and remained static around the village of Ste. Rose du Lac in the R.M. of Ste. Rose. Further west, on the Assiniboine River, the disease also remained stationary, about 750 metres northward from St. Lazare (Estevan, Saskatchewan reported 2 diseased elms making it the western prairie boundary for DED). Generally, despite increases in overall DED intensity, (especially in wild stands), the number of losses of urban elms in 1990 remained below two percent in most CSA communities.

The City of Winnipeg, which is responsible for its own survey and sanitation programs (under the terms of their CSA) marked 11,088 elm trees for removal. Provincial survey crews marked 336 trees in Brandon. The City of Brandon is responsible for removals.

The disease continues to spread along most of southern Manitoba's river systems. Mortality has reached as high as 90% in many wild stands east of the Red River. The spread of the disease west of the Red River, while slower, continues to threaten farm shelterbelts in the areas around Winkler, Altona, Morden and Carman. The Souris River southwest of Brandon is extensively infected in Manitoba and southward into the United States. Most communities in western Manitoba continue to cooperate fully within the CSA program to prevent significant increases in disease infection in their high value municipal elm populations.

During 1990-1991, the Forestry Branch Dutch Elm Disease Sanitation Program removed approximately 15,800 elm trees, many of these from buffer zones established in wild stands outside of the cities of Brandon and Winnipeg. The provincial program continued to rely on assistance from Corrections and Community Services' personnel as part of its removal crew within the sanitation operation during 1990-1991.

The provincial elm removal and sanitation program was supplemented with additional funding in 1990 to meet the challenge of increased disease intensity. In response to the increased removals, Forestry Branch added more departmental sanitation crews and Corrections and Community Service crews to ensure all diseased and hazard trees were removed prior to the 1991 infection season. The quick and timely response of the survey, CSA communities and sanitation components of the DED program allowed Forestry Branch to achieve its long term objective of keeping the provincial average annual loss rate of elms to less than two percent.

The primary vector of Dutch Elm Disease in Manitoba is the native elm beetle, *Hylurgopinus rufipes*. A major concern and possible threat to Manitoba is the migration and establishment of the smaller European elm bark beetle, *Scolytus multistriatus*. This beetle, also a vector of Dutch Elm Disease, has a more aggressive breeding habit and if present would considerably alter the integrated management program.

From 1979 to 1989, *S. multistriatus* has been captured at several locations in the City of Winnipeg. Numbers have been generally low. For the first time in eight years of monitoring, two specimens of *S. multistriatus* were captured at a Forestry Branch monitoring site in 1989. None were captured in 1990. Monitoring of the eight permanent locations across southern

Manitoba will continue. In addition the Forest Protection section produced an in depth cost-benefit analysis of the performance of the Dutch Elm Disease program during the last 15 years since its inception. Copies are available from the Forestry Branch, Forest Protection section.

1990 Elm Tree Replacement Program

Through funding from Manitoba Natural Resources' Environmental Innovations Fund a pilot program was initiated to replace elm trees lost to Dutch elm disease. Traditionally, municipal and provincial programs have replaced trees only on public property. As an incentive for landowners, this program provided approximately 4,000 green ash and basswood saplings as replacements for elms removed from private lands in the City of Winnipeg. A complete report on the Elm Tree Replacement Program is available from the Forestry Branch.

Efficacy Trials with the Herbicide Glowon™

Sanitation or the removal and destruction of dying and diseased elm trees is a major component of the provincial integrated management program for DED. It reduces the amount of breeding material available to native elm bark beetles, the major vector of DED. However, due to limitations in personnel, time, and accessibility, sanitation can sometimes be very costly in relation to the resource being protected.

A method to supplement sanitation which has proven successful in the United States is the use of herbicide desiccants to kill diseased elm trees. Herbicides are injected into the sapwood of elms, killing them and creating trap trees for elm bark beetles. Native elm bark beetles are strongly attracted to these dying trees to breed, but the broods never reach adulthood. The herbicide causes the tree to die quickly and drys out the inner bark and sapwood.

The herbicide Glowon™ (MSMA) was applied to elm in two locations in southern Manitoba during mid-May when elm bark beetles were emerging from overwintering sites. Elm bark beetle activity on experimental trees was monitored throughout the summer using sticky cardboard traps. After cessation of beetle activity in October 1990, 30% of the elm trees were felled and sampled for larval development and brood gallery formation. The extent and number of brood galleries and larval development will help determine the effectiveness of the herbicide in reducing and/or eliminating brood production.

OBJECTIVE #3: To Prevent Forest Nursery Seedling Damage/Loss to Insect and Disease

During 1990-1991 the Forest Protection Section continued to provide diagnostic and extension services to the Pineland and Clearwater Provincial Nurseries.

OBJECTIVE #4: To Provide Information and Technical Assistance to the Public

During 1990-1991 hundreds of public inquiries concerning forest and urban insect and disease problems were handled by Forest Protection staff. The section provided extension services to private companies, the public, other government branches and research organizations concerning identification and information on the management of forest and urban tree insects and disease.

OBJECTIVE #5: To Ensure Effective Forestry Pesticide Applications in a Safe, Efficient and Economical Manner

In addition to the spruce budworm program (Objective #1), Forest Protection is also charged with delivery of the Forestry Branch's herbicide application program within the context of the Silvicultural vegetation management mandate.

In 1990, 286.8 ha of renewed forest were sprayed with Glyphosate at an application rate of 4 L/ha in 45 L/ha of water. Product was applied using a Piston Thrush with 12D-56 nozzles which provided a 20 m swath width.

The program lasted from August 20 to 25, 1990. Operational costs of the program resulted in a per hectare cost of $97.23.

FOREST OPERATIONS

Branch Services

Budget Management

In the 1990-1991 fiscal year the Forest Operations Section of the Forestry Branch met the objectives and responsibilities identified for the section.

In particular, the administration component of the section provided the required expenditure estimates, ongoing monitoring and supporting report documentation to ensure that the branch expenditures were within the target levels identified. The Branch's administration component uses a financial project management system which provides the capability to estimate, monitor and report upon expenditures to ensure the necessary budget control that is required. Each of the branch's sections, regions and nurseries are fully operational on this system. Through the assistance of this system the Forestry Branch was able to track its expenditures to a point that the branch's 1990-1991 actual expenditures were within 0.8% of the budget estimates.

The Forestry Branch 1990-1991 fiscal year budget was allocated and expended as illustrated in table 6.

Table 6: Budget for 1990-1991 Fiscal Year

Current Budget	Staff Years	Budgeted ($1000)	Expended
Director's Office	2.00	5.0	4.4
Forest Management	22.00	155.6	155.3
Silviculture	6.00	452.5	452.1
Forest Protection	24.29	1,719.7	
D.E.D.Supplementary Supply		120.0	
		1,839.7	1,832.9
Forest Operations	30.00	265.6	260.3
Forest Regeneration	13.41	1,586.2	1,583.2
Forest Development	11.00	1,989.3	1,987.9
Forest Renewal	1.0	2,906.3	2,905.4
Sub Total Current Budget	110.18	$9,200.2	$9,181.5
Capital	-	25.0	24.9
Innovations Fund	-	424.0	358.0
TOTAL FORESTRY BUDGET 1990/1991	110.18	$9,649.2	$9,564.4

Contract Supervision

All sections of the branch utilize both tendered and non-tendered contracts and rental agreements in the delivery of their programs. A total of 58 contracts and 67 rental agreements were developed by the branch in the 1990-1991 fiscal year. These contracts were for activities ranging from tree planting, site preparation, aerial photography, computer and other technical service agreements, consulting and research. Operation Section staff have the responsibility to administer and process the support documentation and to ensure that the branch, department and provincial government guidelines are followed at all times in the delivery of these contracts. In all cases these guidelines and procedures were followed and met in the 1990-1991 fiscal year. The Forestry Branch successfully delivered its field operational programs through the use of contracts and rental agreements.

Staffing

The Operations Section also provides administrative support on all personnel matters for the 78 permanent and 15 term employees and approximately 17 permanent departmental employees within the branch. In addition, casual departmentals were employed for time periods ranging from three to fifty weeks to assist with the delivery of field programs such as tree planting, forest protection, tree lifting, and elm tree removal. This was equivalent to approximately 184 additional staff years of assistance. As of March 31, 1991 there were eight permanent and four term positions to be filled. This amounted to a vacancy rate of 11% for the branch. During the 1990-1991 fiscal year there were no permanent or term positions filled through the Civil Service competition process, as a staffing freeze had been imposed.

Personal Computer Support

To meet the overall Forestry Branch objectives and to assist in the delivery of and evaluation of its programs, the Forestry Branch has been expanding its use of computer technology. The Operations Section provides a support role for the purchasing of computer hardware and software, its installation, daily troubleshooting, and programming requirements. During the 1990-1991 fiscal year, staff from the section were actively involved in preparing systems plans for the branch. This plan outlines the needs for the continued development of computer technology within the branch, the necessary hardware and software required to meet this need and the total expenditures required. This plan was approved by the branch's senior staff and the departments's executive.

Forestry Extension

Forest Operations section is responsible for coordinating all branch extension and public information initiatives. During 1990-1991, this included the branch's ongoing support for Forest Week activities and the Manitoba Forestry Association, printing and distribution of educational materials, developing a video on Dutch elm disease and branch representation at mall exhibits and major events (e.g. Red River Exhibition).

The Forestry Branch continued to be represented on the Canadian Forestry Communications Committee, which pursued several forestry initiatives on behalf of the Canadian Council of Forestry Ministers. Joint communications activities with Forestry Canada increased leading up to the signing of the five-year Canada-Manitoba Partnership Agreement in Forestry.

Timber Sales Office

The timber administration component of the Operations Section has the responsibility of providing the administrative support for the management of Manitoba's Crown forests. This includes the development of the necessary documentation for the allocation of timber volumes to the forest industry, the recording and verification of volumes harvested throughout the province, the reporting on these volumes, and the collection and reporting of all revenues for the branch.

The harvest of timber from provincial Crown lands totalled 1,552,354 m^3 for the 1990-1991 fiscal year (Figure 4, Table 7). This comprised of 1,413,313 m^3 of softwoods and 139,041 m^3 of hardwoods. This is 278,453 m^3 less than the previous year and represents a decrease of 15.21%. Only fuelwood production increased compared to 1989-1990; lumber, fence posts, railway ties and pulpwood production decreased (Tables 8,9).

Timber revenue decreased to $2,079,276.43 which represents a 1.37% decline from the previous year (Table 10). This is attributed to deteriorating market conditions such as lower selling prices and the forest industry attempting to bring supply in line with demand.

The timber stumpage rates were reviewed employing the Manitoba Forest Products price index. A new rate was required only for aspen (white poplar) and which came into effect May 1, 1991.

A total of 5,868 timber permits were issued this fiscal year which is an increase of 566 from the previous year (Table 11).

Thirty-three permit quotas were in force in 1990-1991. Timber sale quotas amounted to 180, a decline of 11 from April 30, 1990.

Regional Programs

The regional component of the Operations Section are responsible for the delivery of many of the branch's field programs. This includes the allocating of timber sale areas to the forest industry (Tables 12, 13); assisting the Regional Services Branch in monitoring the forest industry for utilization and enforcement of The Forest Act and Regulations; the delivery of the forest renewal and stand improvement programs required to maintain and/or improve upon the forest resource within the region; to provide Forestry Branch input into land management decisions through representation on the Regional Planning Committee (RPC) and Block Planning Committee (BPC); to maintain liaison with the general public and the forest industry on forestry related matters; and to assist Regional Services in fire management planning and suppressional activities if required.

The regional staff were extremely active in all of these responsibilities in the 1990-1991 fiscal year. In timber management the five-year timber sale areas for quota holders and special allocation holders were implemented. Five-year forest operating plans continued for forest management units 20, 23, 30, 40, 41, 42, and 57. For areas falling within Repap Manitoba's FML, staff were preparing for the transfer of some forest management responsibilities to the company.

Forest renewal activities remained at approximately the same level as previous years and in all cases except for part of the planting program in the Southeast Region, tendered contracts were used to deliver these programs. Delivery of these programs through the tendered contract method went extremely well during this fiscal year and it is the branch's intent to maintain this delivery method as it allows branch staff time to monitor planting quality rather than spending time on personnel and direct supervisory responsibilities.

The major activity through the RPCs evolved around the review and evaluation of the operating plans for Abitibi-Price and Repap Manitoba. These reviews were extremely thorough, requiring considerable input by all parties involved and resulted in a departmental response to the two companies on their operating plans.

Additionally, regional staff were involved in integrated forestry-wildlife management activities. This included a caribou habitat study in Abitibi-Price's FML area and great grey owl nesting area research in the Southeast Region.

Major Section Initiatives

Sustainable Development

During 1990-1991, the Forestry Operations Section was instrumental in the branch's initiative to produce a sustainable development strategy. Public input to the *Sustainable Development Land and Water Strategy-Workbook on Forests* was reviewed by the Forest Strategy working group and the draft forest policies were revised to reflect participants comments. The revised policies will be published in late 1991 under the title *What You Told Us-Workbook on Forests*. Also during 1990-1991 a draft applications document was initiated. This booklet is intended to put the forest policies into context by providing background information, the intent of each policy and a list of expectations for government, business and the public if the province is to achieve sustainable forest development.

Timber Quota System

In September-October 1989, a series of meetings were held with those of the forest industry who presently hold cutting rights under the Manitoba Quota System. The intent of these meetings which were carried out by two independent consultants was to review some of the policies under the present Manitoba Quota System and to provide the industry's input into the report which would be produced by the consultants. Upon completion of this review the consultants submitted a report identifying their recommendations for a timber quota policy for the next ten-year operating period. This report is presently being reviewed by the Forestry Branch and the department's executive. Once approved these modifications to the timber quota policies will be incorporated into the Manitoba Quota System.

Legislation

Legislation was also passed during the year to provide for a forest renewal charge on a per cubic metre basis on all wood harvested in the province. This legislation was passed on March 14, 1990 and will be enacted through additions to the forest regulations after the forest industry is consulted on the actual dollar value of the charge, the starting date and if the charge will be phased in over several years. In keeping with the sustainable development thrust, this forest

Cost Shared Agreement with Canada

The cost-shared Canada-Manitoba Forest Renewal Agreement expired on March 31, 1989. Negotiations for a new agreement were ongoing throughout the year, and the five-year Canada-Manitoba Partnership Agreement in Forestry was signed on March 25, 1991.

Figure 4: percentage of timber produced within departmental regions

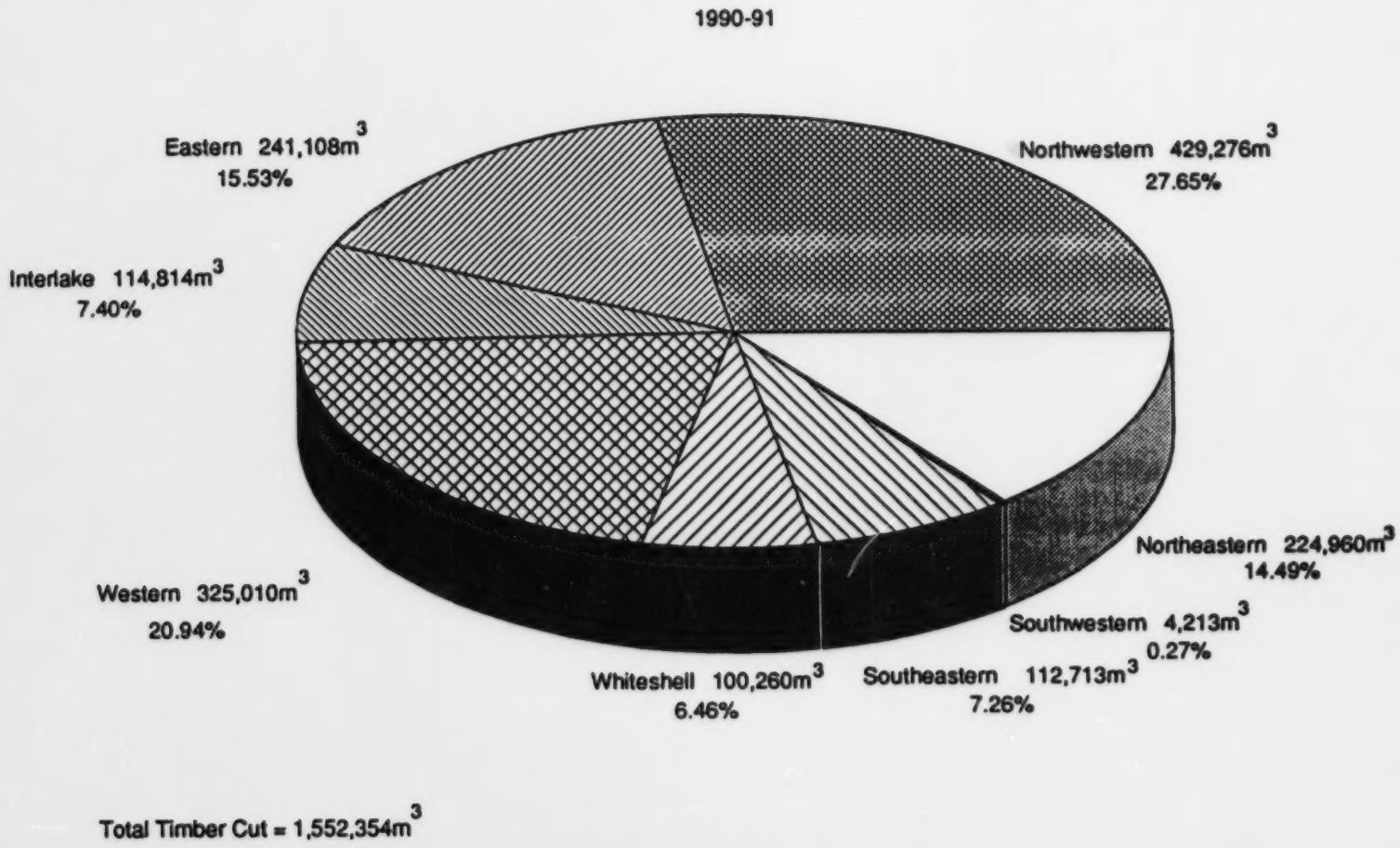


Table 7: Annual forest production by forest product (in cubic metres), 1981-1982 to 1990-1991

Year	Pulpwood		Lumber		Fuelwood		Other		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
1981-1982	1,100,921	61.8	535,034	30.0	88,369	5.0	57,754	3.2	1,782,078	100
1982-1983	787,879	53.3	518,062	35.1	111,555	7.5	60,596	4.1	1,478,092	100
1983-1984	837,756	55.8	509,476	34.0	102,474	6.8	50,626	3.4	1,500,332	100
1984-1985	1,201,970	71.9	330,228	19.7	103,593	6.2	37,240	2.2	1,673,031	100
1985-1986	1,065,361	63.1	474,826	28.1	110,561	6.5	38,149	2.3	1,688,897	100
1986-1987	927,085	55.5	598,168	35.8	98,039	5.9	45,840	2.8	1,669,132	100
1987-1988	1,007,882	54.4	733,269	39.5	84,573	4.6	28,613	1.5	1,854,337	100
1988-1989	1,088,960	58.7	664,544	35.8	85,611	4.6	17,582	0.9	1,856,697	100
1989-1990	992,654	54.2	711,478	38.9	93,632	5.1	33,043	1.8	1,830,807	100
1990-1991	796,118	51.3	630,655	40.6	98,105	6.3	27,476	1.8	1,552,354	100

Table 8: Record of timber scaled or manufactured, 1990-1991

	Lumber - Cubic Metres						Pulpwood - Cubic Metres				Piece Products - Cubic Metres				Piece Products - Pieces	Fuelwood - Cubic Metres: Green						Fuelwood - Cubic Metres		Totals Cubic Metre
	Spruce	Balsam	Jack Pine	Other Soft Woods	Poplar	Other Hard Woods	Spruce	Balsam	Jack Pine	Poplar	Railway Ties	Cedar Poles	Jack Pine Poles	Posts	Christmas Trees	Spruce	Jack Pine	Poplar	Other Hard Woods	Dry	Slabs and Tops	Mine Timber	Round Timber	
Summary by Regions																								
Northeastern	66896		54713		246	30	52753		43662							1051	1310	605	379	3305	3		7	224960
Northwestern	155154	129	107270		6	6	86952		71142					33	25	225	317	1006	1387	5558	20		71	429276
Whiteshell	665		13830	173	7931	1087	23726	1213	18065	16506	48			546	455	29	2664	9495	1018	1813	548		903	100260
Southeastern	1485		5665	132	9106	2403	33811	1364	32542	6219			8	1863	2920	14	485	5512	5582	3687	840		1995	112713
Southwestern	6				25									16	136		2	3261	368	436			99	4213
Eastern	2187		6756	350	4168	538	156413	2033	50700	3894				124	7054	479	1730	3367	1281	6308	2		778	241108
Interlake	18040	128	16596		1297	41	41100	1215	23375	250				279	151	373	482	2074	763	7306			1495	114814
Western	93433		44877		13535	1751	106474		22435	274	47			15833	1658	28	356	9409	5390	7790	47		3331	325010
Total	337866	257	249707	655	36314	5856	501229	5825	261921	27143	95	0	8	18694	12399	2199	7346	34729	16168	36203	1460	0	8679	1552354
Summary by Status of Land																								
Provincial Forests																								
Spruce Woods																		200	5				58	263
Duck Mountain	53737		20859		13179	1751	53358		8139	274	-15			879	1171	15	62	3991	3386	2202			2202	164019
Porcupine	29317		16955		75		41334		9476		63			14655	205	4	93	1768	756	2304	37		386	117223
Sandilands	1435		7109	119	7288	1090	25195	400	33120	10460			8	1634	1488	14	1473	6275	3844	2890	495		1502	104351
Cormorant	6393		726				560		458					10		68	145	33	740	1483			12	10628
Agassiz	73		2906	81	3782	24	6723		1238	9850				26	292	18	1135	6200	897	639	403		226	34221
Belair			2565	300	600	75	17125		5926	3209					144		23	302	188	351	2			30666
N.W. Angle	50			20	2102	2376	14127	1672	2314	604				391	10		7	213	1247	53	28		222	25426
Turtle Mountain														3				41	75	115				234
Whiteshell	592		9452	85	2870		5839	338	9840	475	47			10	27	29	338	863	49	821	85		315	32048
Cat Hills									135											13			5	153
Brightstone																		217	81	25				323
Moose Creek							3853											25		20			28	3926
Wampum																		65		75				140
Swan-Pelican														3			31	22	10	47			72	185
Total Provincial Forests	91597	0	60572	605	29896	5316	168114	2410	70646	24872	95	0	8	17611	3337	148	3307	20215	11278	11038	1050	0	5028	523806
Other Provincial Land	246269	257	189135	50	6418	540	333115	3415	191275	2271				1083	9062	2051	4039	14514	4890	25165	410		3651	1028548
Total	337866	257	249707	655	36314	5856	501229	5825	261921	27143	95	0	8	18694	12399	2199	7346	34729	16168	36203	1460	0	8679	1552354
Summary by Method of Disposal																								
Permit	3844		1582	392	2866	699	21164	2425	17319	20136			8	3087	5012	2114	6821	31149	10998	35808	1446		6687	168545
Sales	19628	128	25780	263	17404	3679	161375	3400	63955	6891	110			15087	7387	73	394	3255	4632	149	9		435	326647
Berths	314394	129	222345		16044	1478	318690		180647	116	-15			511		12	126	325	495	230			1557	1057084
Seizures														9			5		43	16	5			78
1990-91 Total	337866	257	249707	655	36314	5856	501229	5825	261921	27143	95	0	8	18694	12399	2199	7346	34729	16168	36203	1460	0	8679	1552354
			630655						796118										98105					
1989-90 Total	393296	151	267690	1415	45885	3041	604798	4057	346651	37148	1107	0	0	24478	12855	1660	7389	33631	17295	31661	1996	178	7280	1830807
			711478						992654										93632					

Table 9: Summary of timber cut on crown land, 1990-1991

Product	Species	Cubic Metres		Percentage
Lumber	Spruce, Pine, Fir, Tamarack, Cedar	588,485		
	Poplar, Birch and other hardwoods	42,170	630,655	40.63
Pulpwood	Spruce, Pine, Fir,	768,975		
	Poplar	27,143	796,118	51.28
Railway Ties	Pine		95	0.01
Line Poles	Cedar, Pine, Tamarack, Spruce		8	0.00
Fence Posts	Cedar, Pine, Tamarack, Poplar, Spruce, Oak		18,694	1.20
Round Timber	Spruce, Pine, Tamarack		8,679	0.56
Mining Timber	Pine, Spruce		0	0.00
Fuelwood	Birch, Poplar, Pine Spruce and other		98,105	6.32
TOTAL 1990-1991			**1,552,354**	**100.00**
TOTAL 1989-1990			**1,830,807**	

Table 10: Revenue from the sale of crown timber

Year	Total Harvest (in cubic metres)	Revenue[1]
1981-1982	1,782,078	1,792,589.82
1982-1983	1,478,092	1,383,734.70
1983-1984	1,500,332	1,964,510.80
1984-1985	1,673,031	2,302,339.73
1985-1986	1,688,897	2,473,081.25
1986-1987	1,669,132	2,682,289.37
1987-1988	1,854,337	2,961,462.33
1988-1989	1,856,697	2,622,014.79
1989-1990	1,830,807	2,108,127.18
1990-1991	1,552,354	2,079,276.43

[1] Dues in respect of Crown timber harvested.

Table 11: Permits, licences and quotas on crown lands (including provincial forests), 1989-1990 and 1990-1991

	1989-1990	1990-1991
Timber Dealers and Sawmill Licences		
Timber Dealers	57	56
Sawmill Licences	86	66
Permits and Licences Covering Timber Cutting Rights		
Permits	5,302	5,868
Timber Sale Agreements		
Awarded	14	167
Previously Awarded	198	30
Timber Seizures Recorded	7	7
Timber Allocations in Force on March 31st		
Timber Sales	191	180
Timber Permits	36	33
Forestry Revenue (Crown Charges)	$2,913,937.71	$3,592,314.63

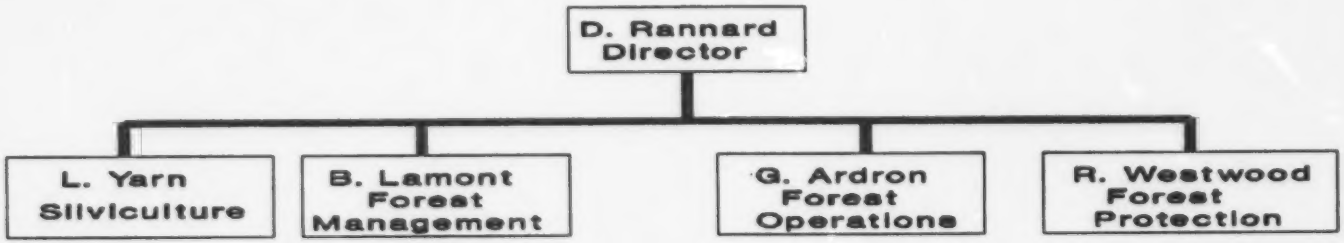
Table 12: Timber cut by departmental region, 1990-1991

Region	Cubic Metres	Percentage
Eastern	241,108	15.53
Interlake	114,814	7.40
Northeastern	224,960	14.49
Northwestern	429,276	27.65
Southeastern	112,713	7.26
Southwestern	4,213	0.27
Western	325,010	20.94
Whiteshell	100,260	6.46
TOTAL	**1,552,354**	**100.0**

13: Permits and leases in provincial forests 1989-1990 and 1990-1991

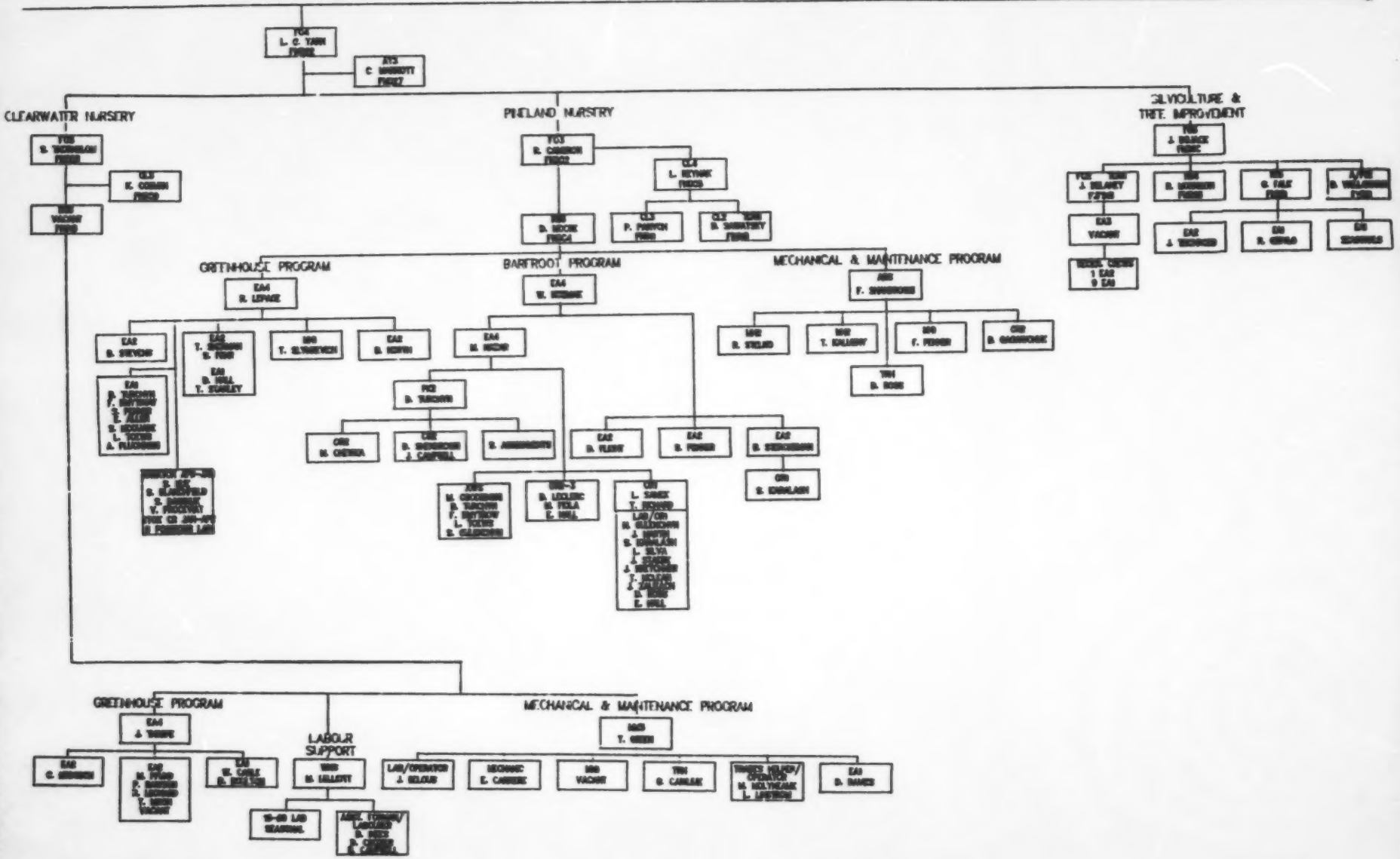
	1989-1990	1990-1991
General Permits and Leases		
Sawmill Site	1	-
Trappers' Cabins	34	34
Hunting and Fishing Cabins	6	6
Other Lodges, Cabins, Residences	5	9
Grazing Fences	-	-
Maintain Roads and/or Spurlines	2	3
Youth Groups (Camping and Sports)	4	5
Land Use for Municipal Purposes	8	8
Land Use for Government Purposes	11	4
Miscellaneous	20	25
	91	94
Hay Permits		
Number of Permits	15	10
Tonnes of Hay	227.49	170.81
Grazing Permits		
Number of Permits	3	3
Head of Livestock	60	56

Forestry Branch Organization Chart

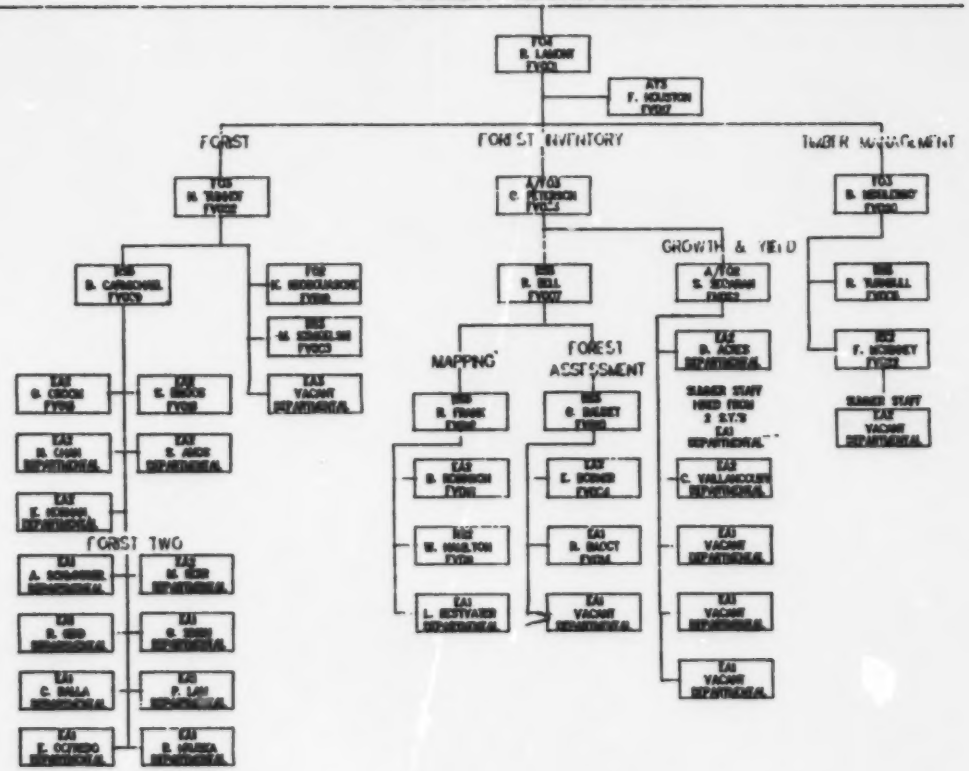


For further Organizational detail see following pages.

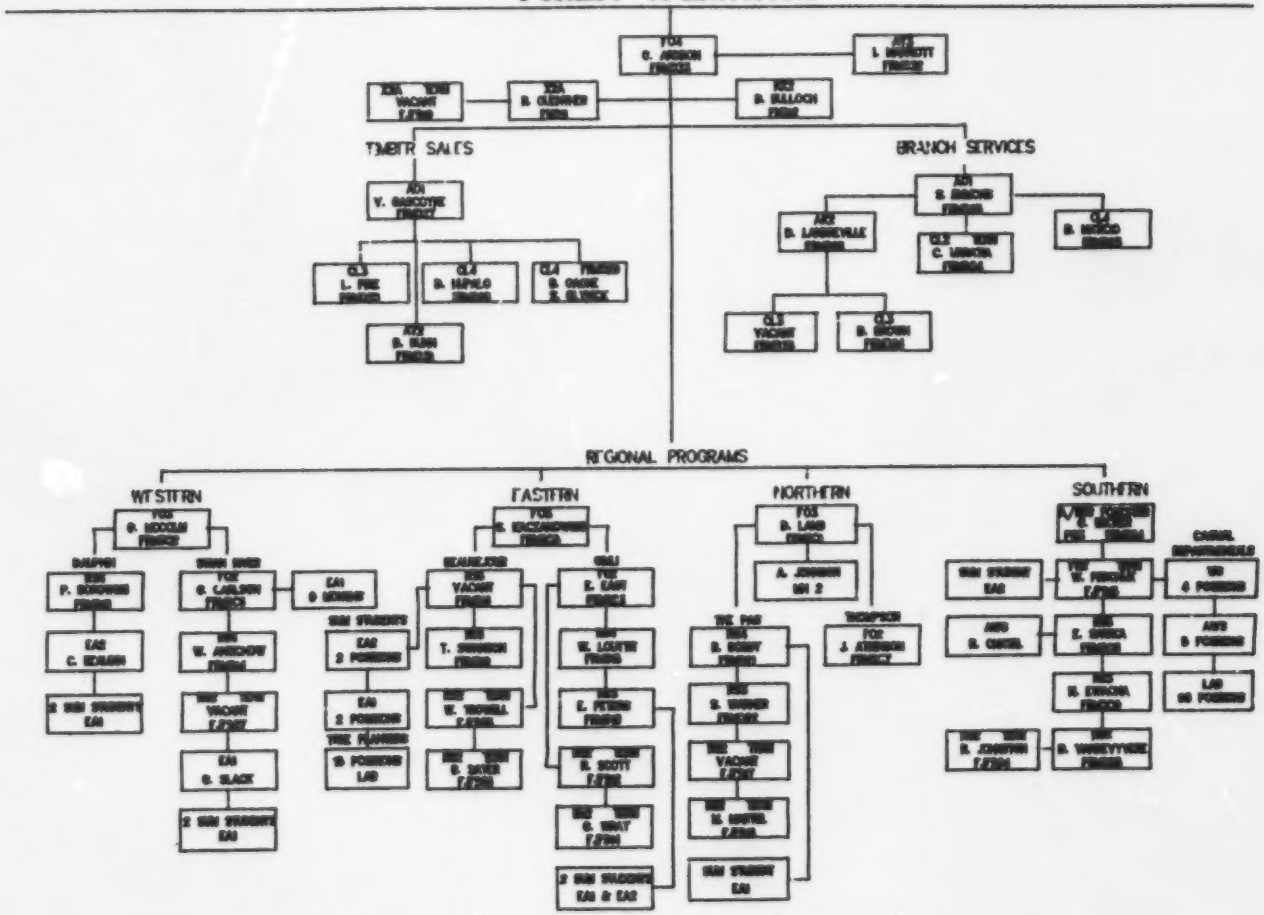
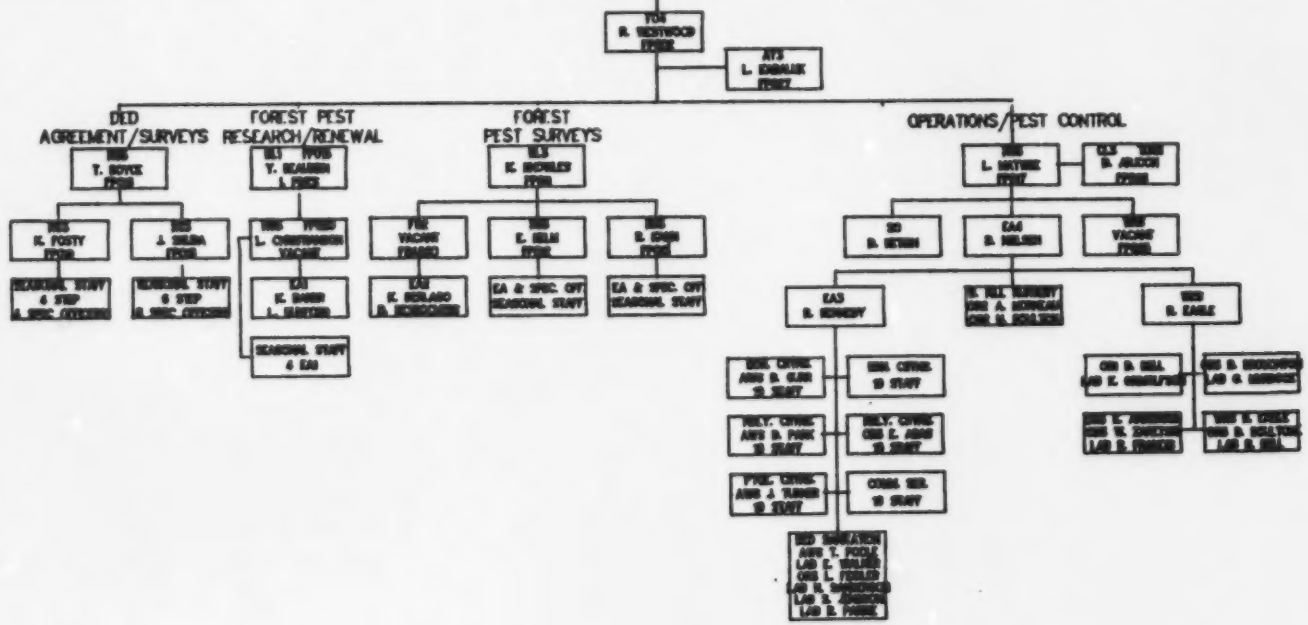
SILVICULTURE



FOREST MANAGEMENT



FOREST OPERATIONS



FOREST PROTECTION